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CLAIMS

1. A frequency and phase control apparatus, comprising:
  - a signal input section for receiving a reproduction signal;
  - an analog/digital conversion section for converting the reproduction signal into a multiple bit digital signal based on a clock signal;
  - a maximum likelihood decoding section for converting the multiple bit digital signal into a binary signal;
  - a pattern detection section for detecting a pattern of the binary signal;
  - a determination section for determining whether or not the multiple bit digital signal and the clock signal are in synchronization with each other based on the detection result; and
  - a clock generation section for adjusting at least one of a frequency and a phase of the clock signal based on the detection result and outputting the adjusted clock signal,
- wherein when the determination result of the determination section indicates that the multiple bit digital signal and the clock signal are in synchronization with each other, the maximum likelihood decoding section generates a binary signal based on a first state transition rule; and when the determination result of the determination section indicates that the multiple bit digital signal and the clock signal are not in synchronization with each other, the maximum likelihood decoding section generates a binary signal based on a second state transition rule.
2. A frequency and phase control apparatus according to claim 1, wherein:

a number of states and a number of state transition paths of the first state transition rule are restricted based on a first minimum inversion interval defined by a prescribed symbol rule, and

5 a number of states and a number of state transition paths of the second state transition rule are restricted based on a second minimum inversion interval which is shorter than the first minimum inversion interval.

10 3. A frequency and phase control apparatus according to claim 2, wherein:

the first minimum inversion interval is 2,

the second minimum inversion interval is 1,

15 the first state transition rule includes 6 states and 10 state transition paths based on a combination of a recording symbol having the first minimum inversion interval and a PR (a, b, b, a) system, and

20 the second state transition rule includes 8 states and 16 state transition paths based on a combination of a recording symbol having the second minimum inversion interval and the PR (a, b, b, a) system.

4. A frequency and phase control apparatus according to claim 2, wherein:

25 the first minimum inversion interval is 3,

the second minimum inversion interval is 1,

the first state transition rule includes 6 states and 8 state transition paths based on a combination of a recording symbol having the first minimum inversion interval 30 and a PR (a, b, b, a) system, and

the second state transition rule includes 8 states and 16 state transition paths based on a combination of a recording symbol having the second minimum inversion interval and the

PR (a, b, b, a) system.

5. A frequency and phase control apparatus according to  
claim 2, wherein:

5           the first minimum inversion interval is 2,  
              the second minimum inversion interval is 1,  
              the first state transition rule includes 4 states  
and 6 state transition paths based on a combination of a  
recording symbol having the first minimum inversion interval  
10        and a PR (a, b, a) system, and  
              the second state transition rule includes 4 states and  
8 state transition paths based on a combination of a recording  
symbol having the second minimum inversion interval and the  
PR (a, b, a) system.

15        6. A frequency and phase control apparatus according to  
claim 2, wherein:

              the first minimum inversion interval is 3,  
              the second minimum inversion interval is 1,  
20        the first state transition rule includes 4 states  
and 6 state transition paths based on a combination of a  
recording symbol having the first minimum inversion interval  
              and a PR (a, b, a) system, and  
              the second state transition rule includes 4 states and  
25        8 state transition paths based on a combination of a recording  
symbol having the second minimum inversion interval and the  
PR (a, b, a) system.

30        7. A frequency and phase control apparatus according to  
claim 2, wherein:

              the first minimum inversion interval is 2,  
              the second minimum inversion interval is 1,  
              the first state transition rule includes 10 states

and 16 state transition paths based on a combination of a recording symbol having the first minimum inversion interval and a PR (a, b, c, b, a) system, and

5 the second state transition rule includes 16 states and 32 state transition paths based on a combination of a recording symbol having the second minimum inversion interval and the PR (a, b, c, b, a) system.

10 8. A frequency and phase control apparatus according to claim 2, wherein:

the first minimum inversion interval is 3,  
the second minimum inversion interval is 1,  
the first state transition rule includes 8 states  
15 and 12 state transition paths based on a combination of a recording symbol having the first minimum inversion interval and a PR (a, b, c, b, a) system, and

20 the second state transition rule includes 16 states and 32 state transition paths based on a combination of a recording symbol having the second minimum inversion interval and the PR (a, b, c, b, a) system.

9. A frequency and phase control apparatus according to claim 2, wherein:

25 the first minimum inversion interval is 3,  
the second minimum inversion interval is 2,  
the first state transition rule includes 6 states  
30 and 8 state transition paths based on a combination of a recording symbol having the first minimum inversion interval and a PR (a, b, b, a) system, and

the second state transition rule includes 6 states and 12 state transition paths based on a combination of a recording symbol having the second minimum inversion interval and the PR (a, b, b, a) system.

10. A frequency and phase control apparatus according to  
claim 2, wherein:

5                   the first minimum inversion interval is 3,  
                  the second minimum inversion interval is 2,  
                  the first state transition rule includes 4 states  
and 6 state transition paths based on a combination of a  
recording symbol having the first minimum inversion interval  
and a PR (a, b, a) system, and

10                  the second state transition rule includes 4 states and  
6 state transition paths based on a combination of a recording  
symbol having the second minimum inversion interval and the  
PR (a, b, a) system.

15                 11. A frequency and phase control apparatus according to  
claim 2, wherein:

20                   the first minimum inversion interval is 3,  
                  the second minimum inversion interval is 2,  
                  the first state transition rule includes 8 states  
and 12 state transition paths based on a combination of a  
recording symbol having the first minimum inversion interval  
and a PR (a, b, c, b, a) system, and

25                  the second state transition rule includes 10 states and  
16 state transition paths based on a combination of a recording  
symbol having the second minimum inversion interval and the  
PR (a, b, c, b, a) system.

30                 12. A frequency and phase control apparatus according to  
claim 1, wherein:

                  when intervals between a plurality of  
synchronization patterns included in the detected pattern  
have a defined value for a prescribed number of times in  
series, the determination section determines that the

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multiple bit digital signal and the clock signal are in synchronization with each other, and

when intervals between a plurality of synchronization patterns included in the detected pattern 5 do not have a defined value for a prescribed number of times in series, the determination section determines that the multiple bit digital signal and the clock signal are not in synchronization with each other.